Code No: R09220206 **R09** **Set No. 2**

II B.Tech II Semester Examinations,APRIL 2011
ELECTRICAL MACHINES-II
Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. A 15kW, 400V, 950 rpm, 3 phase, 50 Hz, 6 pole cage motor with 400V applied takes full load current at standstill and develops 1.8 times the full load running torque. The full load current is 32A.
   (a) What voltage must be applied to produce full load torque at starting?
   (b) What current will this voltage produces?
   (c) If the voltage is applied by an auto transformer what will be the line current.
   (d) If the starting torque is limited to full load current by an auto transformer, what will be the starting torque at 5% of full load torque. The magnetizing current and stator impedance drops are neglected. [15]

2. (a) What current flows in the transformer primary when its secondary is open? What is its function? Give its order of magnitude and power factor?
   (b) A 100 KVA, 2400/24 V, 50 Hz single phase transformer has an exciting current of 0.64A and a core loss of 700 watts, when its high voltage side is energised at related voltage and frequency. Calculate the two components of the exciting current. [7+8]

3. (a) What is meant by slip in an induction motor? Develop an expression for the frequency of rotor currents in it.
   (b) Find the running speed of a 4 pole induction motor working on a 50Hz supply having 3% slip. [7+8]

4. Calculate the steps in a 5 step rotor resistance starter for a 3 phase induction motor. The slip at the maximum starting current is 5% with slip ring short circuit and the rotor resistance per phase is 0.025 ohm. [15]

5. (a) Discuss in detail about on-load tap changing of transformers.
   (b) Write about Scott connection of transformer. [7+8]

6. (a) Develop the equivalent circuit of a single phase transformer.
   (b) The constants of a single phase, 2200/220 V, 50 Hz transformer are as follows:
   H.V. side : $R_1 = 0.21\Omega$, $X_1 = 3.84\Omega$
   L.V. side : $R_2 = 0.006\Omega$, $X_2 = 0.022\Omega$
   Find the equivalent circuit parameters refered to L.V. side? [7+8]

7. A 50 KVA, 2200/110 V, transformer when tested gave the following results
   OC test(lv side) : 400 W, 10 A, 110 V
   SC test(hv side) : 808 W, 20.5 A, 90 V
   Calculate
   (a) the equivalent circuit parameters when refered to h.v. side.
   (b) the efficiency at full load with 0.8 power factor lagging. [15]

8. (a) What happens if the emf is injected to the rotor circuit of induction motor?
   (b) An 8 pole, 50 Hz, 3 phase induction motor is running at 4 percent slip when delivering full load torque. It has standstill rotor resistance of 0.1 ohm and reactance of 0.6 ohm per phase. Calculate the speed of the motor if an additional resistance of 0.5 ohm per phase is inserted in the rotor in the rotor circuit. The full load torque remains constant. [7+8]

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Code No: R09220206 **R09** **Set No. 4**

II B.Tech II Semester Examinations,APRIL 2011
ELECTRICAL MACHINES-II
Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. Draw the circuit diagram for a 200V, 3.667KW 3 phase star connected induction motor from the following tests & data
   No load: 200V, 5.0 A, 350W
   Locked rotor: 100V, 26A, 1700W
   From the circuit diagram determine
   (a) No load current, full load power factor
   (b) Speed and torque. [15]
2. Explain the following:
   (a) Why an induction motor can not develop torque when running at synchronous speed?
   (b) Why the power factor of a lightly loaded induction motor is quite low?
   (c) Why in some induction motors double cages are provided? [15]
3. The instrument obtained from open and short circuit tests on 10 KVA, 450/120 V, 50 Hz transformer are:
   O.C. test : $V_1 = 120$ V, $I_1 = 4.2$ A, $W_1 = 80$ W.(H.V. side open) S.C. test : $V_1 = 9.65$ V, $I_1 = 22.2$ A, $W_1 = 120$ W.(L.V. side Short circuited) Compute
   (a) the equivalent circuit parameters when refered to primary side.
   (b) Efficiency at full load with 0.8 lagging power factor. [7+8]
4. (a) Define voltage regulation of a transformer. List out the factors that effect voltage regulation.
   (b) A 25 KVA, 2000/200 V, 50 Hz transformer has maximum efficiency at 75% of full load. Its per unit resistance and impedance are 0.012 and 0.05 respectively. Determine its efficiency and voltage regulation at half of the full load and 0.8 p.f lagging. [7+8]
5. (a) Distinguish the transformers
      i. based on the arrangement of core
      ii. based on its location
   (b) The no-load current of a transformer is 5A at 0.25 power factor when supplied at 235V, 50 Hz. The number of turns on the primary winding is 200. Calculate
      i. the maximum value of flux in the core

ii. the core loss and

iii. the magnetising component. [7+8]

6. A bank of three single phase transformers has its h.v terminals connected to 3-wire, 3-phase, 33 kV system. Its l.v terminals are connected to a 3-wire, 3-phase load rated at 3000 KVA, 2200 V. Specify the voltage, current and KVA ratings of each transformer for both h.v and l.v windings for the following connections

   (a) Δ - Δ

   (b) Y - Y

   (c) Y - Δ

   The first symbol indicates h.v winding and the second symbol l.v winding. [15]

7. (a) Explain briefly the different methods of speed control from rotor side of 3 phase indiction motor.

   (b) The stand still impedances of outer and inner cages of a double cage induction motor are (4+j2.4) ohm and (1+j7) ohm respectively. Determine the slip at which the cages develop equal torque. [7+8]

8. (a) Describe the development of electro magnetic torque in a squirrel cage induction motor through the interaction of flux and mmf wave, when the rotor is running at a speed less than synchronous speed.

   (b) A 3 phase induction motor runs at almost 1000 rpm at no load and 950 rpm at full load when supplied with power from a 50 Hz phase line.

      i. How many poles has the motor?

      ii. What is the corresponding speed of the rotor field with respect to the rotor?

      iii. What is the corresponding frequency of the corresponding voltage?

      iv. What is the rotor frequency at the slip of 10%? [7+8]

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Code No: R09220206 **R09** **Set No. 1**

II B.Tech II Semester Examinations,APRIL 2011
ELECTRICAL MACHINES-II
Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Draw the exact equivalent circuit of a transformer and describe briefly the various parameters involved in it.
   (b) A 230/460 V transformer has a primary resistance of 0.2Ω and reactance of 0.5Ω and the corresponding values for the secondary are 0.75Ω and 1.8Ω respectively. Find the secondary terminal voltage when supplying 10A at 0.8 p.f lagging and its voltage regulation. [7+8]
2. (a) Explain the principle of operation of polyphase induction motor.
   (b) A 3 phase 50 Hz induction motor is running at 1440 rpm determine the slip and slip speed. [7+8]
3. (a) Define a transformer. How is the energy transferred from one circuit to the other? Distinguish between step up and step down transformers.
   (b) A 10 KVA, 1-phase transformer has a turn ration of 300/23. The primary is connected to 1500 V, 60 Hz supply. Find the secondary volts on open circuit and the appropriate values of the currents in the two windings on full - load. Also find the maximum value of the flux. [7+8]
4. Discuss the following connections of 3-phase transformers with relavent relations amongest voltages and currents on both h.v and l.v sides.
   (a) star - delta
   (b) delta - delta
   (c) Scott connection [15]
5. A single phase 200/400 V, 6 KVA, 50 Hz transformer gave the following results.
   OC test(lv side) : 200 V, 0.8 A, 80 W
   SC test(hv side) : 25 V, 10 A, 90 W
   Determine
   (a) the circuit constants refered to l.v side.
   (b) the efficiency at full load with 0.8 lagging p.f. [15]
6. (a) Explain the effect of number of poles, applied frenquency on speed control of induction motor.
   (b) A 4 pole induction motor and a 8 pole induction motor are connected cumulatively cascade. The frenquency in the secondary circuit of the 6 pole motor is observed to be 2.5 Hz. Detremine the slip in each machine and the combined speed of the set. Take supply frenquency as 50 Hz. [7+8]

7. (a) Two wattmeters are used to measure the power input of a 3-phase, induction motor running at no load one of the watt meter give negative reading. Why? Explain.

   (b) A 3-phase, 50 Hz, 6-pole induction motor has a slip of 1% at no load and 3% at full load. Find synchronous speed, no load speed, full load speed, frequency of rotor current at stand still, frequency of rotor current at full load. [7+8]

8. The ratio of maximum torque to full load torque in a squirrel cage induction motor is 2.2:1. Determine the ratio of actual starting torque to full load torque to full load troque for the following cases

   (a) direct starting

   (b) star delta starting

   (c) auto transformer starting with tapping of 70%

   (d) The rotor resistance and stand still reactance per phase are 0.5 and 5 ohm respectively. [15]

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Code No: R09220206 **R09** **Set No. 3**

II B.Tech II Semester Examinations,APRIL 2011
ELECTRICAL MACHINES-II
Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define an auto - transformer. Discuss the relative merits and demerits of an auto transformer.
   (b) The instrument readings obtained from open and short circuit tests on 10 KVA, 450/120 V, 50 Hz transformer are :
   O.C. test : $V_1 = 120$ V, $I_1 = 4.2$ A, $W_1 = 80$ W.
   S.C. test : $V_1 = 9.65$ V, $I_1 = 22.2$ A, $W_1 = 120$ W.
   Calculate the efficiency and voltage regulation at full load with 0.8 lagging power factor. [7+8]

2. (a) What happens if the emf is injected to the rotor circuit of induction motor?
   (b) A 12 pole, 3 phase alternator is coupled to an engine running at 600 rpm. It supplies a 3 phase induction motor having a full load speed of 1400 rpm. Find the % of slip and no of poles of motor. [7+8]

3. (a) Develop the phasor diagram of a single-phase transformer under lagging p.f. load.
   (b) The no-load current of a transformer is 15A at a power factor of 0.2 when connected to a 460V, 50 Hz supply. If the primary winding has 550 turns, calculate
      i. the magnetising component of no-load current
      ii. the iron loss
      iii. the maximum value of the flux in the core. [7+8]

4. (a) Derive the condition of maximum torque developed on a 3 phase induction motor and hence prove that to increase the starting torque extra resistance must be added in the rotor circuit.
   (b) Discuss the production of starting torque through the concept of interaction of flux and mmf waves in a 3-phase slip ring induction motor. [7+8]

5. A 3 phase, 400V, 4 pole, 50Hz induction motor has a star connected stator and rotor. The rotor resistance and stand still reactance/phase are 2.5ohm and 1.2ohm respectively. The ratio of stator to rotor trun is 1.3. the full load slip is 4%. Calculate
   (a) the power and torque developed at full load
   (b) maximum torque and the speed at which it occurs. [15]

6. A bank of three single-phase transformers has its h.v. terminal connected to 3-wire, 3-phase, 11 kV system. Its l.v terminals are connected to a 3-wire, 3-phase load rated at 1500 KVA, 2200 V. Specify the voltage, current and KVA ratings of each transformer for both h.v and l.v windings for the following connections.

   (a) Y - Δ

   (b) Δ - Y

   (c) Δ - Δ

   The first symbol indicats h.v winding and the second symbol l.v winding. [15]

7. (a) Develop the equivalent circuit of a transformer.

   (b) A 200/600 V transformer has a primary resistance of 0.2Ω and reactance of 0.5Ω and the corresponding values for the secondary are 0.75Ω and 1.8Ω respectively. Find the secondary terminal voltage when supplying 10A at 0.8 p.f lagging and its voltage regulation. [7+8]

8. A 3-phase wound rotor induction motor develops a maximum torque of 4 times the full load torque at a slip of 0.20. The per phase rotor resistance is 0.40 ohm. The stator resistance and rotational losses are negligible.

   (a) Calculate the slip at full load torque. If the stator resistance were considered, would the value of slip at full load torque be smaller, same or large?

   (b) Calculate the value of external resistance that must be inserted in rotor circuit in order to obtain maximum torque at starting. [15]

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